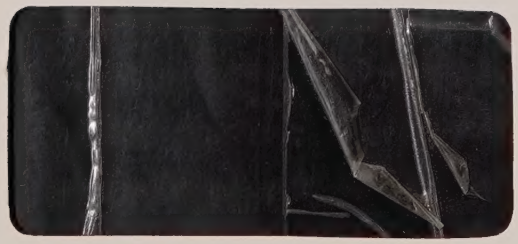
INSTRUCTION MANUAL

Telonic

INDUSTRIES, INC



MODEL SD-4

SERIAL NO. 4067

SWEEP GENERATOR

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes and semiconductors excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

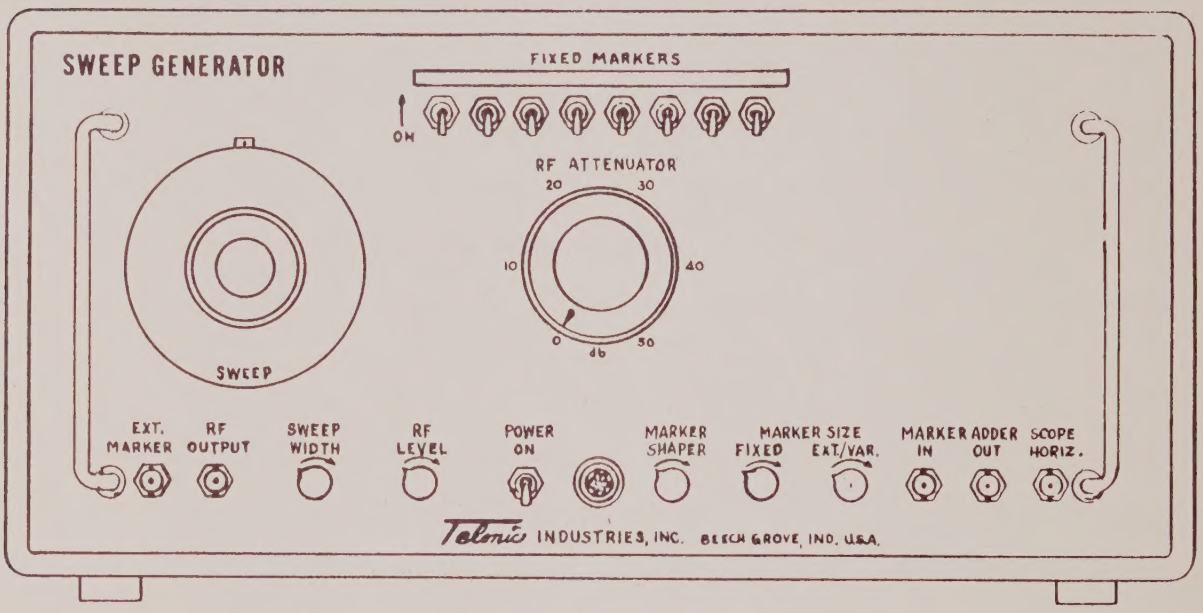
RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

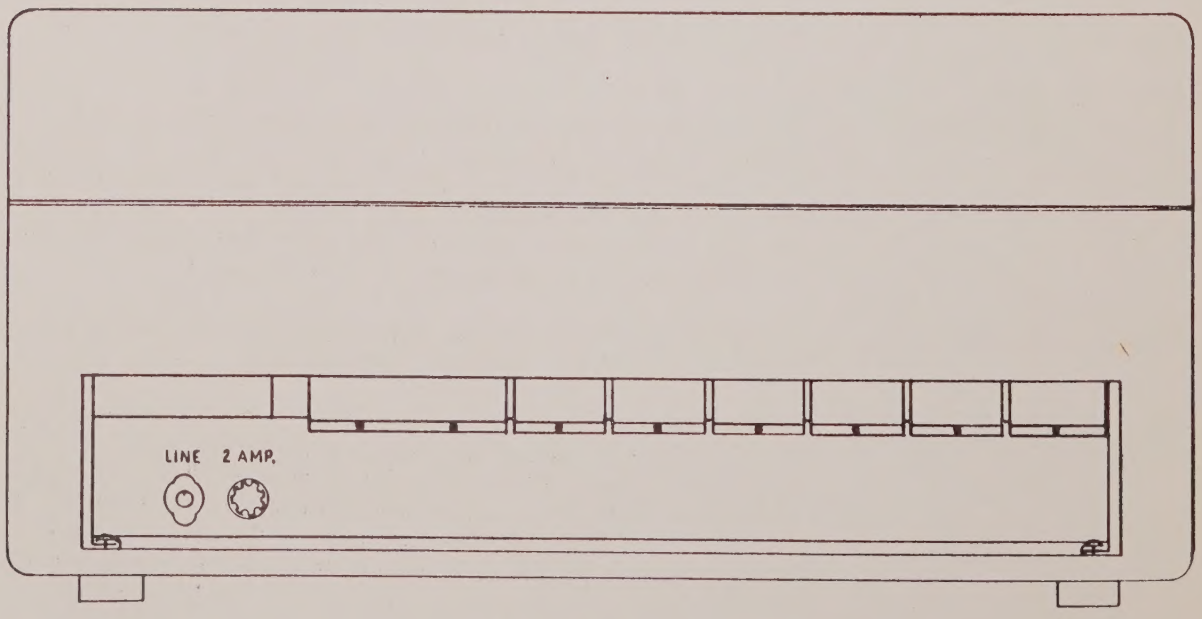
SPECIFICATIONS

MODEL SD-4 SWEEP GENERATOR

CENTER FREQUENCY	930 to 1250 MC
FREQUENCY RANGE	900 to 1260 MC
SWEEP WIDTH	100 KC to 50 MC
OUTPUT	
Voltage	2 volts peak to peak.
Impedance	50 ohms.
Flatness	5% over maximum sweep width.
ATTENUATION	
Step	0, 10, 20, 30, 40, 50 db.
Vernier	0 to over 10 db.
DISPLAY LINEARITY	Normally below 1.2:1.
RADIATION	Less than 10 microvolts.
SWEEP RATE	Line Frequency (50-60 cps.)
ZERO BASE LINE	Oscillator off 50% of the time during return sweep.
SCOPE HORIZONTAL SWEEP	Approximately 14 volts peak to peak.
SOURCE VSWR	Normally below 1.2:1.
POWER	115 V. 50/60 cps. Approximately 100 watts.
MARKER SYSTEM	
Birdy-By-Pass Marker Circuitry	The output of the marker oscillators is mixed with a signal from the sweep oscillator to produce beatnotes or birdies. These are amplified and superimposed upon the detected RF output signal before it is applied to the vertical scope input. Amplitude and shape of the markers are adjustable over a wide range.
External Marker Input	An external CW signal of approximately 0.1 volts may be used to produce a "birdy" type marker.
Plug-In Crystal Markers	Provisions for 8 single frequency type markers ("C" type) or 4 harmonic type (CDH) type, or combinations of "C" and "CDH" type. Frequency of "C" type should be specified when ordering. Normal accuracy of crystals is .005%. Frequency of the CDH type is 5 mc. on models up to approximately 500 mc. and 10 mc. on models above 500 mc.
PHYSICAL DESCRIPTION	Panel Size - 1/8" x 8 3/4" x 19". Chassis Size - 2" x 14 1/2" x 17".



FRONT



REAR

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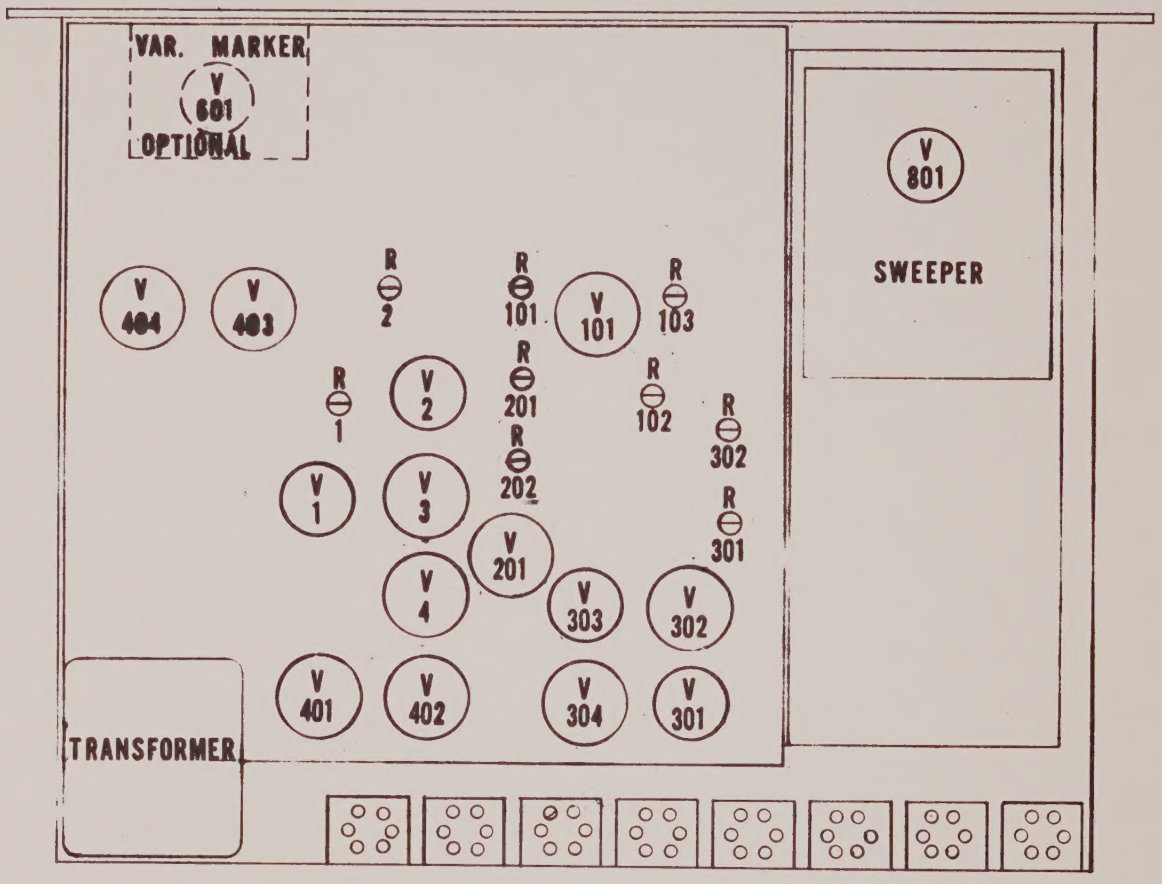
DESCRIPTION OF FRONT PANEL

SWEEP DIAL	Indicates center frequency of the sweep oscillator at minimum sweep width (not used on models with fixed center frequencies).
RF ATTENUATOR	Turret Attenuator provides indicated amounts of attenuation.
VARIABLE MARKER (Optional Equipment)	
Dial	Calibrated dial indicates the frequency of the marker.
Switch	Supplies B$\neq$ to the variable marker when in the on position.
FIXED MARKERS	These switches supply B$\neq$ to the fixed markers (crystal plug-in units) when in the on position.
RF OUTPUT	RF sweep output - BNC Connector - Impedance 50 ohms.
EXTERNAL MARKER	Marker input for external signal source.
SWEEP WIDTH	Varies the amount of voltage supplied to the vibrating capacitor and can be used to vary the sweep width.
RF LEVEL	Determines the average B$\neq$ supplied to the sweep oscillator and may be used as a vernier level control.
POWER ON	Switches AC power on and off.
MARKER SHAPER	Varies the width of the marker signals.
MARKER SIZE	
Fixed	Varies the amplitude of the fixed markers (crystal plug-in units).
Ext/Var	Varies the amplitude of the external and variable marker signals.
MARKER ADDER	
In	The demodulated signal from the device being tested is fed into this connector so that marker signals may be superimposed.
Out	This connector should be connected to the vertical input terminals of the scope for viewing the demodulated signal and markers.
SCOPE HORIZONTAL	This connector should be connected to the scope horizontal amplifier input.

CHASSIS LAYOUT



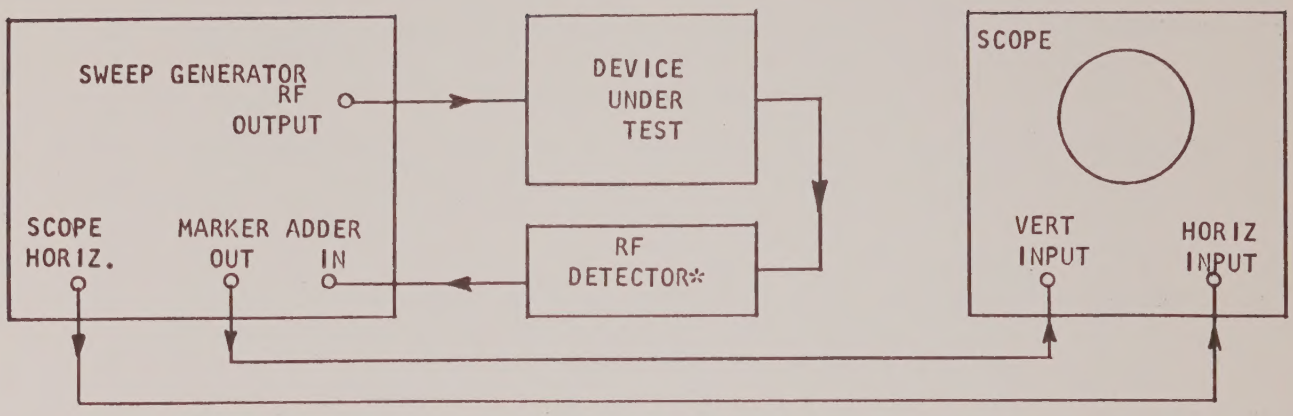
V1	5651
V2	6AU6
V3	EL84/6BQ5
V4	EL84/6BQ5
V101	12AX7
V201	12AX7
V301	6AU6
V302	12AX7
V303	6AU6
V304	EL84/6BQ5
V401	12AX7
V402	12AX7
V403	12AX7
V404	12AX7
V601	6AF4 (optional)
V801	6AF4

R1	B+ Adjust
R101	Horizontal Phase
R102	Linearity
R103	Horizontal Size
R2	Sweep Width Limit
R201	Blanking Phase
R202	Blanking Width
R301	Level Maximum
R302	Level Minimum

DESCRIPTION OF CHASSIS CONTROLS

R1 - B+ ADJUST	This control varies the bias on the amplifier, (V2), for the B+ regulator, (V3), and is adjusted to produce a regulated B+ voltage (B+2) of 175 volts.
R2 - SWEEP WIDTH LIMIT	This potentiometer controls a voltage supplied to the front panel SWEEP WIDTH control and is used to adjust the sweep width when the front control is set at maximum.
R101 - HORIZONTAL PHASE	This control adjusts the phase of the scope horizontal sweep voltage with reference to the phase of the sweep oscillator.
R102 - LINEARITY	This control can be used to change the waveform of scope horizontal output (V101). It is normally set for best linearity at maximum sweep width.
R103 - HORIZONTAL SIZE	This control adjusts the size of the horizontal output when the Front Panel Sweep Width control is set to its maximum position. It is adjusted to maintain a constant horizontal size at all sweep width settings.
R201 - BLANKING PHASE	This control adjusts the phase of the blanking pulse with reference to the phase of the sweep oscillator.
R202 - BLANKING WIDTH	This control is the grid resistor for the blanking pulse generator (V201). It is adjusted to blank one-half of the sweep cycle to produce a zero base line.
R301 - LEVEL MAXIMUM	This control is used to adjust the output level when the front panel LEVEL control is at its maximum position.
R302 - LEVEL MINIMUM	This control is used to adjust the output level when the front panel LEVEL control is at its minimum position. (On units that use no front panel LEVEL control the LEVEL MAXIMUM control on the printed circuit board controls the average B+ voltage supplied to the sweep oscillator and is used to adjust the RF output to a value as shown on the specification sheet. On these models the LEVEL MINIMUM control performs no function.)

OPERATING INSTRUCTION



TYPICAL SET UP - The following procedure is recommended for setting up this instrument in test position.

1. Connect unit to proper power line voltage and turn POWER ON switch to ON position.

2. Make connections to the scope, the device under test, and RF Detector as shown above. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between each device, minimizes hum, leakage from unit and pick up of spurious external signals. The cable that is used to connect the RF OUTPUT to the device under test should match the impedance of the sweep generator. If the input impedance of the device under test is different than the impedance of the sweep generator, a matching network should be used to insure a constant input signal.

3. Adjust the RF output level by means of the OUTPUT LEVEL or VERNIER ATTENUATOR control and the step RF ATTENUATOR to the proper input signal for the device being tested. Failure to do this will result in incorrect reading on the scope.

4. Adjust the SWEEP WIDTH control and center frequency SWEEP DIAL to cover the desired frequency range.

5. MARKERS
   Markers may be produced by one or more of the following methods depending on the specific unit.
   A. Plug-in crystal markers (C type).
   B. Plug-in crystal harmonic markers (CDH or CH type).
   C. Internal variable marker.
   D. External CW Signal.
   First turn on marker unit or inject external CW signal and adjust MARKER SIZE and SHAPER until markers are of a convenient size and width.

*See Telonic literature for detector recommended for use with this instrument.

INTERNAL CONTROL ADJUSTMENT

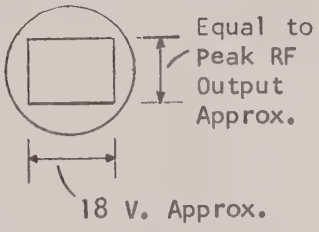
PRINTED WIRING BOARD CONTROLS are adjusted at the factory and normally do not require any readjustment. However, should it be desirable to check these adjustments, follow these steps.

1-Connect unit as shown under operating instructions but omit the device under test. The recommended detector for the unit is the Telonic XD-3A. Turn unit on.

2-B+2 ADJUSTMENT: Adjust R1 to provide a regulated B+ voltage of 175 volts (blue wire).

3-BLANKING PHASE and WIDTH ADJUSTMENTS: Set SWEEP WIDTH control to its maximum counter-clockwise position; OUTPUT LEVEL control to its maximum clockwise position and the Attenuator to its 0 db. position. A rectangular pattern should appear on the scope.

Adjust SCOPE VERTICAL and HORIZONTAL SENSITIVITY controls to present a pattern as shown. Vertical amplifier should be DC coupled, pattern will deflect up or down depending on output polarity of the RF Detector. Patterns shown with Telonic XD-3A half-wave detector with negative output.



A vertical line indicates no horizontal output, first check scope and connecting cables, then trouble shoot horizontal sweep section.

A horizontal line with zero amplitude indicates no RF Output. First check scope, RF Detector and connecting cables. Adjust R301 (see step 4). Refer to Maintenance, Page 13.

A horizontal line deflected below zero indicates no blanking. Trouble shoot the blanking generator.

If pattern is not rectangular, adjust BLANKING WIDTH and PHASE controls R201 and R202.

BLANKING PHASE

Misadjusted

BLANKING WIDTH

Misadjusted

BLANKING PHASE & WIDTH

Misadjusted

4-RF OUTPUT MIN and MAX ADJUSTMENTS: Adjust LEVEL MAXIMUM control R301 until vertical height of the pattern equals 1/2 of the peak to peak RF output voltage shown on the specification sheet, Page 1. Since the RF Detector is approximately 90% efficient, the actual RF output voltage will be slightly higher than the voltage shown on the scope. Turn turret attenuator to 10 db. position and record the height of the pattern. Return the turret attenuator to the 0 db. position. Turn the RF OUTPUT LEVEL control to its maximum counter-clockwise position and adjust LEVEL MINIMUM control, R302, until the height of the pattern is slightly less than it was with 10 db inserted in the output circuit. This procedure insures that the OUTPUT LEVEL control will provide over 10 db. of vernier attenuation. An alternate method to perform the above adjustments is to use a RF power meter in place of the RF Detector. Keep in mind that the sweep oscillator is blanked off for 1/2 of each cycle, therefore, the reading on the power meter will have to be double to obtain the actual RF output power.

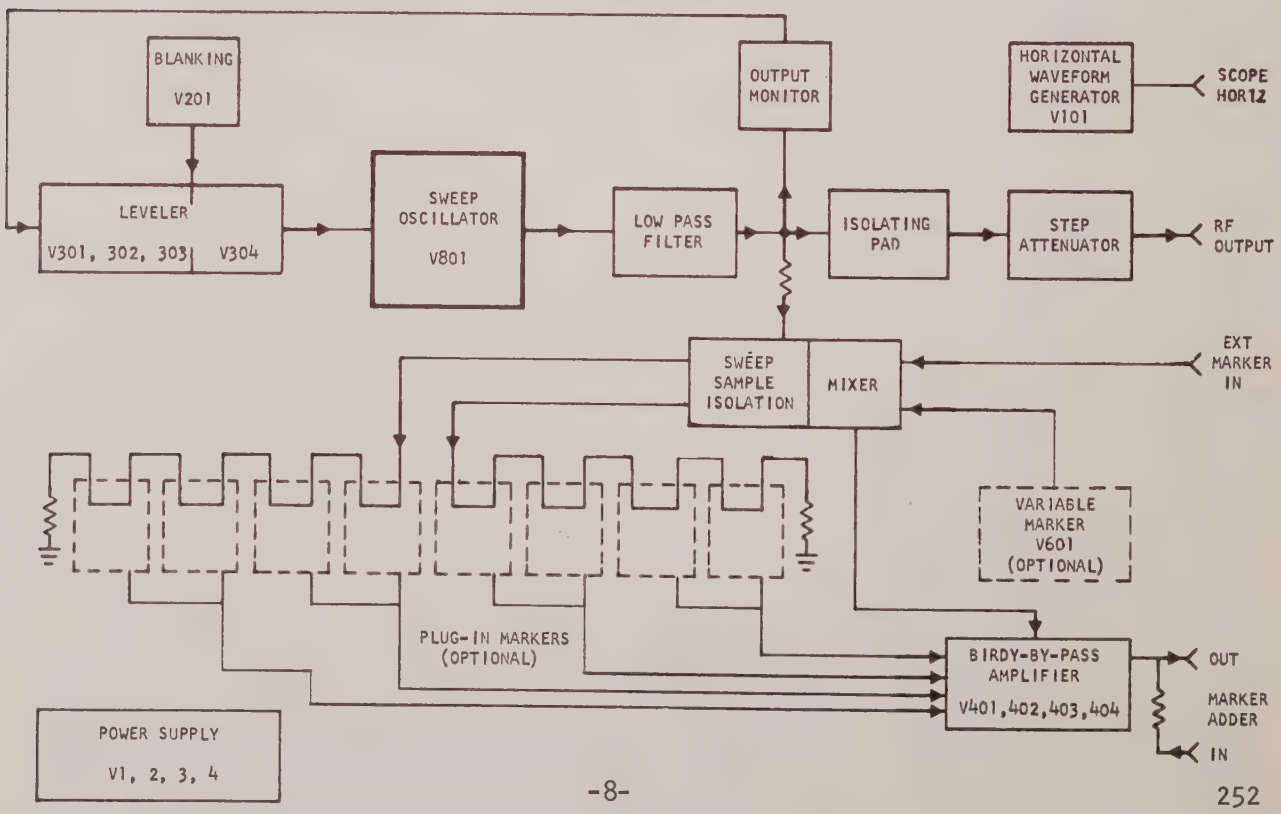
HORIZONTAL PHASE and SIZE ADJUSTMENTS: Return OUTPUT LEVEL control to maximum clockwise position. Set SWEEP WIDTH control to its maximum clockwise position. If pattern is not rectangular, adjust HORIZONTAL PHASE, R101, until a rectangular pattern is obtained. If Horizontal Size has increased or decreased, adjust HORIZONTAL SIZE, R103, until pattern has the same horizontal size as it had with the SWEEP WIDTH control in its counter clockwise position.

MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

6-SWEEP WIDTH ADJUSTMENT: With the SWEEP WIDTH control on the Front Panel in its maximum clockwise position, adjust the SWEEP WIDTH LIMIT, R2, to provide the maximum sweep width as shown on the specification sheet, Page 1.

7-LINEARITY ADJUSTMENT: Linearity may best be adjusted when a number of markers are present on the display. In the factory, a harmonic generator is used for this purpose. The LINEARITY control, R102, is adjusted for equal spacing between the markers. Adjusting the LINEARITY control will change the size of the scope horizontal signal, therefore, the HORIZONTAL SIZE must be readjusted, see step 5. The HORIZONTAL PHASE control also has an effect on linearity and can be adjusted slightly to obtain optimum linearity. Generally it is adjusted to spread the markers at the low frequency side of the display as much as possible and still maintain a rectangular pattern. If a harmonic generator is not available, a variable marker may be used. The linearity adjustment is made so that there is an equal spacing from the center of the presentation to each side.

BLOCK DIAGRAM



SWEEP OSCILLATOR

The sweep oscillator of this unit is a fundamental frequency type, using a 6AF4 tube and tuned line circuitry. A vibrating capacitor, consisting of a silver plated beryllium copper diaphragm is used to obtain this sweep.

BLANKING AND HORIZONTAL CIRCUITRY

The blanking and horizontal sweep voltages are originated by square wave producing circuits. The 6.3 V. filament windings and 6.3 V. phasing windings of the power transformer are connected in series to obtain a 12.6 voltage center - tapped to ground. This voltage is connected through the phasing networks to the grid of V101 (12AX7) to the grid of V201 (12AX7).

The square wave output of V201 controls V304 (EL84), the sweep oscillator voltage regulator tube, and thus deprives the sweep oscillator of voltage during one-half of each cycle. The phase of this blanking voltage is adjusted by the chassis control, so that the lowest frequency being swept is located at the left of the scope presentation. The square wave output of one triode of V101 (12AX7) is applied to the other triode through an RC network. This network is designed to produce a non-linear sawtooth waveform. A potentiometer in this circuit allows the shape of the waveform to be adjusted.

The second triode is connected as a cathode follower and produces the same sawtooth output. This horizontal sweep voltage compensates for the non-linear characteristics of the vibrating sweep capacitor at high sweep widths.

At sweep width from minimum to about 50%, the vibrating sweep capacitor is quite linear. In order to maintain almost perfect linearity for all values of sweep width, a potentiometer is ganged with the sweep width potentiometer which automatically changes the scope horizontal sweep voltage from a sinusoidal waveform at low sweep width settings to a distorted sawtooth waveform at the high sweep width settings.

AUTOMATIC OUTPUT LEVELING CIRCUITRY

A sample of the sweep oscillator output is detected by the monitor diode, located in the monitor block. This detected signal is then amplified and used to control the plate voltage of the sweep oscillator. The OUTPUT LEVEL control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change, and varies the average B+ supplied to the sweep oscillator from a minimum of 25V to over 100V. A small decrease in the sampling voltage causes a large increase in the B+ supplied to the sweep oscillator, and thus counteracts any amplitude variation as the oscillator is tuned over the range.

The operation of this circuit and of the sweep oscillator can be checked at Pin 1 of V301. The waveform at this point will normally show a flat output level over the entire band. Adjusting the OUTPUT LEVEL will change this level.

To replace the monitor diode, remove the insulated holding screw in the monitor block and then remove diode from the block.

POWER SUPPLY

The power transformer output of 140 volts AC is fed into a half wave voltage doubler, using silicon rectifying elements CR1 and CR2. B+ is taken off the capacity input filter to provide +395 volts unregulated to the plates of V-3, (B+ Regulator Pass Tube) V304 (Oscillator Pass Tube) and V4 (Marker B+ Pass Tube).

B+2 is the output of the electronic regulator circuit, consisting of V2 and V3, and provides +175 volts regulated. Potentiometer R-1 controls the operating point of V2, regulator amplifier, and is set for proper B+2 output voltage.

B+3 is obtained by biasing the grid of V4 at approximately 85 volts positive, which causes current to flow through cathode resistor R-20. The voltage at Pin 3, V4, is supplied to the Plug-In Markers and maintains its regulation due to the low impedance characteristics of the cathode follower circuit, and provides approximately 100 volts.

The B- voltage is obtained by the half wave Silicon rectifier CR3. Regulator tube V1 maintains this voltage at -87 volts, and supplies bias voltage to the leveler circuit as well as a reference voltage for the electronic regulator.

Resistor R4 acts as a fuse, protecting the transformer and rectifiers from overload.

The primary of the power transformer is normally wired for 115 volt AC line operation. However, it can be converted to operate from a 230 volt AC source if desired. This conversion is described in the maintenance section.

MARKER SYSTEM DESCRIPTION

GENERAL

A sample of the sweep signal is mixed with the fundamental or a harmonic of the crystal plug-in marker units or external signal to produce beatnotes or birdies. These birdies are then amplified and superimposed upon the demodulated swept signal and applied to the vertical amplifier of the oscilloscope. The size and shape of the marker may be varied over a wide range by the SIZE and SHAPER Control of the birdy amplifier.

EXTERNAL MARKER INPUT

The CW signal from the external marker input is fed into a diode mixer, where it is mixed with a sample of the sweep signal to produce birdies. The resultant birdy is then fed into the birdy-by-pass amplifier.

PLUG-IN MARKERS

This unit has provisions for a maximum of eight single frequency (C Type) crystal markers, eight harmonic (CH type) crystal markers, or four harmonic (CDH type), or any combination. Each CDH type marker occupies the space of two C or CH type.

Two sweep sample outputs are available from the sweep oscillator, in order to minimize coupling between marker signals. For optimum operation harmonic and single frequency markers should not be fed from the same sweep sample line.

SINGLE FREQUENCY MARKERS (C TYPE)

These crystal markers are self-contained plug-in units. Additional units at other frequencies (within the range of the sweep generator) may be ordered and substituted for the original units.

The crystal oscillator units include the tube, crystal oscillator tuning, crystal diode mixer, and a tuned circuit selecting the sweep input frequency. A test point is provided for easy adjustment of the overtone crystal oscillator (this circuit used above 12 mc.). In making this adjustment, the crystal oscillator coil slug is adjusted for near maximum voltage at the test point. This is usually in the order of 2-5 volts as measured with a VTVM. The adjustment should be made just slightly off the peak on the low inductance side, since the effects of tuning are critical on the other side of the resonance curve. Crystal oscillators below 12 mc. are Pierce type oscillator circuits which require no tuning.

By tuning the sweep sample coil, the frequency of the sweep input signal can be varied and thus minimize unwanted markers generated from other harmonics of the crystal oscillator. The amplitude can be varied by adjusting the coupling.

HARMONIC MARKERS

Harmonics of a crystal-controlled oscillator are mixed with a portion of the sweep signal to produce a display of markers at regular intervals across the sweep range.

CH TYPE - This type utilizes a single tube and produces harmonic markers over a limited range.

CDH TYPE - This type uses two tubes and therefore will produce harmonics over a much larger range than the CH type. For example, the CH type, 1 mc., harmonic generator will produce harmonic markers to approximately 25 mc. where the CDH type, 1 mc., harmonic generator will produce markers to over 300 mc.
(See our literature on plug-in markers for additional information).

POWER SUPPLY: Since a defect in the power supply will affect all circuits, it should be checked for proper operation before proceeding to other circuits.

SUPPLY	NOMINAL VALUE	NORMAL VARIATION	NORMAL RIPPLE	WIRE COLOR*
AC Line	115V	-------	-------	-------
B+1	375	±15 volts	6 to 15 volts	Red
B+2	175	±.5 volts	12 to 25 millivolts	Blue
B+3	100	+5-10 volts	15 millivolts to .5 volts	Orange
B-	-82	±2 volts	100 millivolts	White
6.3 "A"	6.3V AC	Main filament supply.		Green
6.3 "B"	6.3V AC	180° out of phase with supply "A". Source of phasing and filament voltages.		Gray
6.3 "C"	6.3V AC	Isolated filament voltage for tubes with cathodes above ground.		Brown

Next: If power supply is operating normal, use the block diagram to isolate the trouble to a major section. Check tubes, diodes, and adjustment of Front Panel and printed wiring board controls located within that section (see Page 7 for adjustment procedure). By the use of the schematic, ordinary difficulties encountered can be readily located and remedied. The following trouble-shooting chart is an additional aid to servicing:

SYMPTON	POSSIBLE CAUSE AND REMEDIES
Pilot Light Off and Unit Fails to Operate	Fuse open - replace. If second fuse opens - look for cause of overload, shorted wiring, components, etc.
B+1 Off Value or Excessive Ripple	Check R4, C1, C2, CR1, and CR2.
B+2 Off Value or Excessive Ripple	Check R1 for proper adjustment. Check R15, it will burn out if B+2 is overloaded. Check V1, V2, V3, tubes and circuitry.
B+3 Off Value or Excessive Ripple	Check R17 and R21 (these resistors adjust the voltage on the grid of V4, a cathode follower, which in turn determines the voltage on the cathode). Check R18 (this resistor will burn out if B+3 is overloaded). Check V4 and C2.
B- Off Value or Excessive Ripple	Check C3, C4, C5, CR3, R3, R5, and R6. Check V1 to see if it is lit properly (should be a steady orange glow).

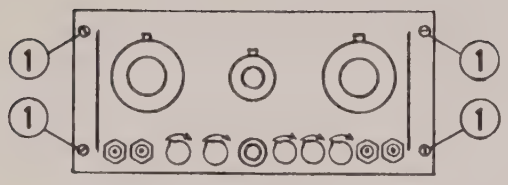
*Wire colors do not apply to shielded wires - single wires only.

V1 Not Lit Properly	If replacing V1 and checking the above parts **does** not remedy the trouble, check the line voltage. **Low** line voltage could cause this trouble. Reducing the value of R3 slightly will usually eliminate this difficulty.
RF Output is Low or Zero	Check R314 - this resistor will burn out if the B+ to the Sweep Oscillator is overloaded. Check B+ to the Sweep Oscillator, cathode of V304. It should be a positive square wave of 25-100 volts and should vary as the OUTPUT LEVEL control varies. If it is normal, look for RF difficulties, defective tube, components, shorted or open wiring, etc. If the voltage is low and does not respond to the LEVEL control, remove first V303 and then V201. When either of these tubes conducts, the voltage on the grid of V304 (pin 2) is reduced and thus decreases the B+ to the Sweep Oscillator. If removal of V201 allows the B+ on V304 (pin 3) to return to normal, check the blanking tube, controls, and associated circuitry. If removal of V303 causes the B+ to return to normal, check the LEVELER controls, V301 and V302, tubes, and associated circuitry.
Poor Leveling	Replace monitor diode. Also replace V301, V302, and V303. V301 is the most critical since it is in the first stage of the DC coupled amplifier. Resetting the printed circuit LEVEL controls is sometimes necessary if these tubes are replaced.
Weak Markers	Replace IN82 or IN34 crystal diode mixer, adjust the coupling and tuning of the sweep sample input. Check Birdy-By-Pass Amplifier, tubes and circuitry.
No Horizontal Output	Look for difficulty in the sawtooth circuitry V101, using the printed circuit board layout and schematic to check waveforms and voltages.

CONVERSION FOR 230 VOLT POWER LINES

The dual primary of the power transformer is normally wired in parallel for use on 115 volt AC lines. If desired, the windings can easily be reconnected in series for use with 230 volt power. With the aid of the Chassis Layout, bottom view, locate terminals 1, 2, 3, and 4. Remove the jumper wires between terminals 1 and 2 and between terminals 3 and 4. Then install a jumper wire between terminals 2 and 3.

RACK MOUNTED UNIT



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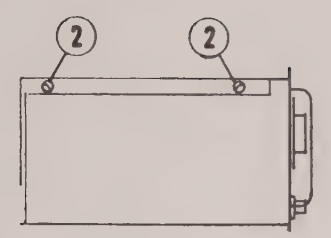
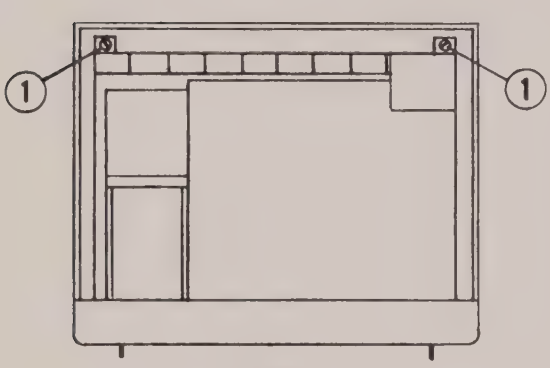


SIDE

Unit has front panel slotted or drilled for standard RTMA Mounting. Position unit in rack and install mounting screws in holes marked 1.
Dust cover removal: Remove four #8-32 thread-cutting screws, marked 2 (two on each side) and lift off cover for easy access to chassis.

CABINET MOUNTED UNIT



TOP

FRONT

To remove chassis from cabinet; first remove the two #8-32 screws (marked 1 on top view above) at the back of the chassis (one on each side). These screws fasten the chassis to the cabinet guide rails. Second, remove the four #10-32 screws (marked 2 in front view above). The screws hold the panel to the cabinet.

Slide chassis out of cabinet by pulling forward on the two front panel handles.

To replace chassis in cabinet, insert the flanges on the bottom of the chassis side panels into the slot of the cabinet guide rails. Push chassis back into cabinet far enough for the slots in the side panel flanges to align with the retained nut in guide rail. Install the two #8-32 screws and tighten securely. Replace the four #10-32 screws in the front panel.

PART VALUE INFORMATION

SCHEMATIC PART DESIGNATION	
C	Capacitor
CR	Crystal Rectifier, Germanium Diode
F	Fuse
I	Incandescent Pilot Light
J	Jack or termination, Coaxial Connector
K	Cable
L	Coil
M	Meter or Motor
P	Plug, Coaxial Connector
R	Resistor, Fixed or Variable
S	Switch
T	Transformer
V	Tube
Z	Miscellaneous

SCHEMATIC VALUE ABBREVIATION	
Ω	ohms
K Ω	1,000 ohms
M Ω	1,000,000 ohms (megohms)
µf, uf	Microfarad
pf	Picofarad
µh, uh	Microhenry
mh	Millihenry

RESISTORS - All resistors are 1/2 watt ± 10%, and are shown in ohms, unless otherwise specified.

NOTE: Resistors in the attenuator pads are ± 2%.

CAPACITORS - All Capacitors are shown in picofarads (pf) unless otherwise specified.

COILS - All coils are shown in microhenries (µh) unless otherwise specified.

PARTS LOCATION - F.P. Front Panel
P.C.B. Printed Circuit Board
R.P. Rear Panel
C.H. Chassis
T.P. Test Point

PARTS NUMBERS - LOCATION INFORMATION

1 - 99 - Power Supply
101 - 199 - Horizontal and Alternate Sweep Drive Circuit
201 - 299 - Blanking
301 - 399 - Leveler
401 - 499 - Birdy-By-Pass
501 - 599 - Mixer & Plug-In Markers
601 - 699 - Variable Markers
701 - 799 - Attenuators
801 - 899 - Sweep Oscillator and Sweep Drive Circuit
901 - 999 - Modifications and Special Circuits

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

—○— 16 Indicates printed circuit board terminal.

N O T I C E

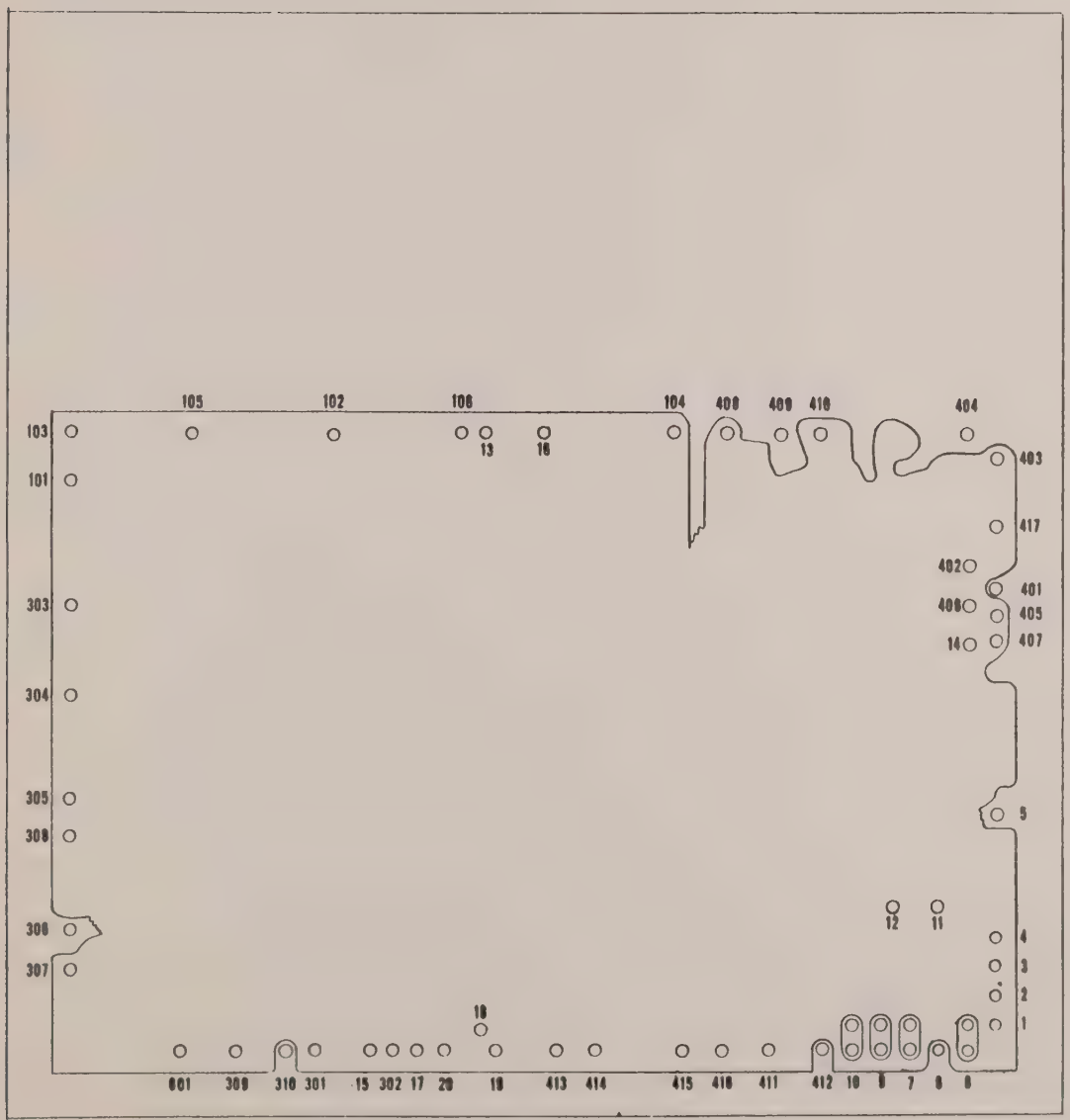
RED LACQUER IS USED TO INDICATE FASTENINGS THAT SHOULD NOT BE DISTURBED FOR ORDINARY SERVICE, AND TO SECURE ADJUSTABLE CONTROLS.

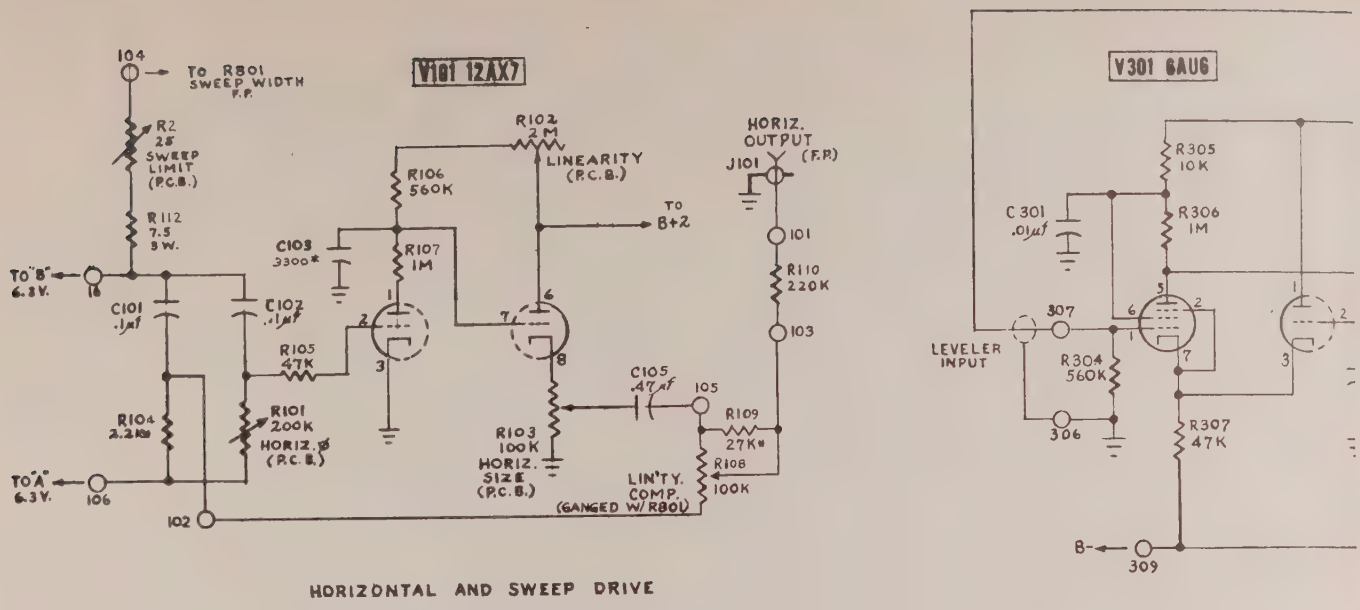
CHASSIS LAYOUT

BOTTOM VIEW

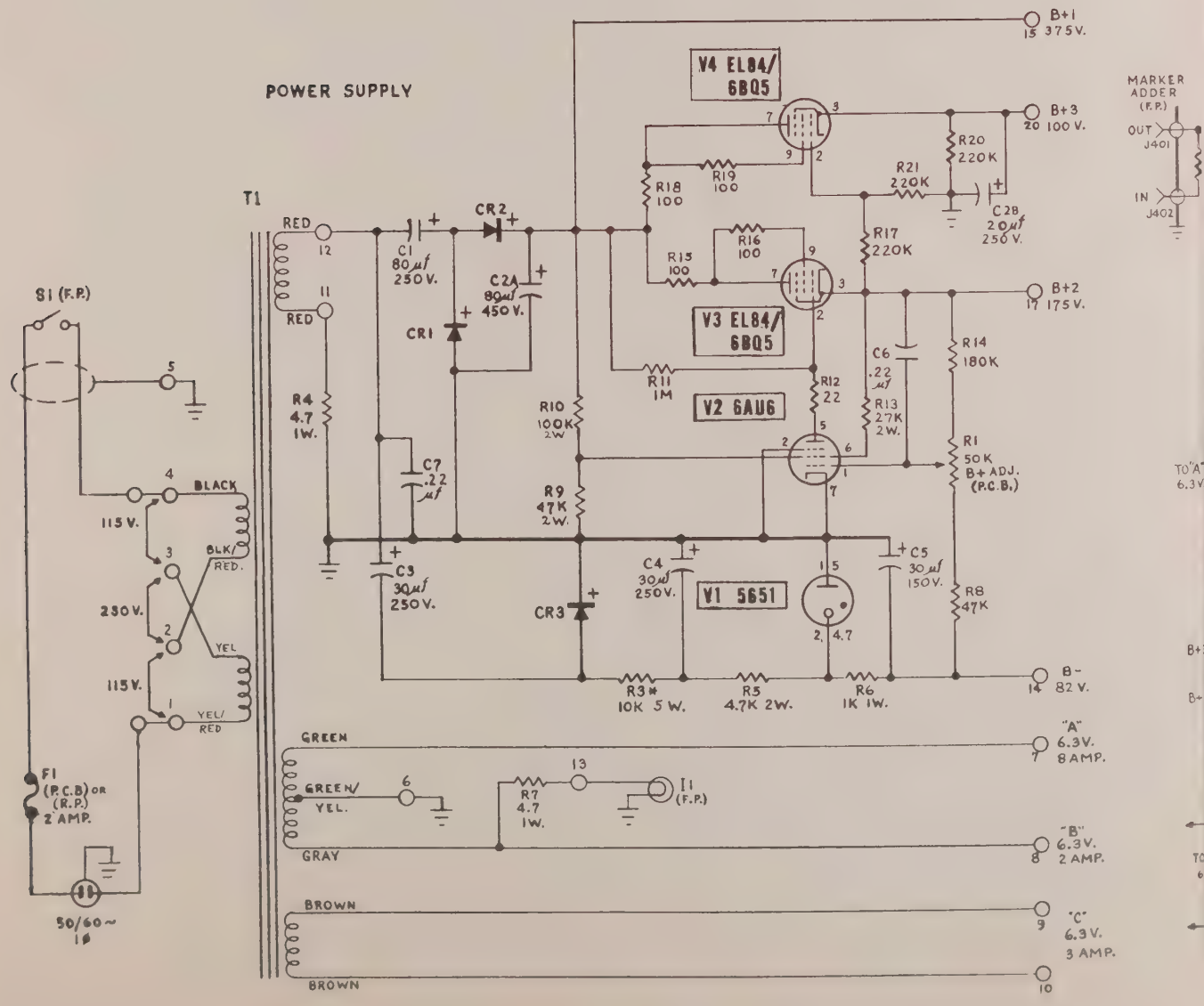
TERMINALS

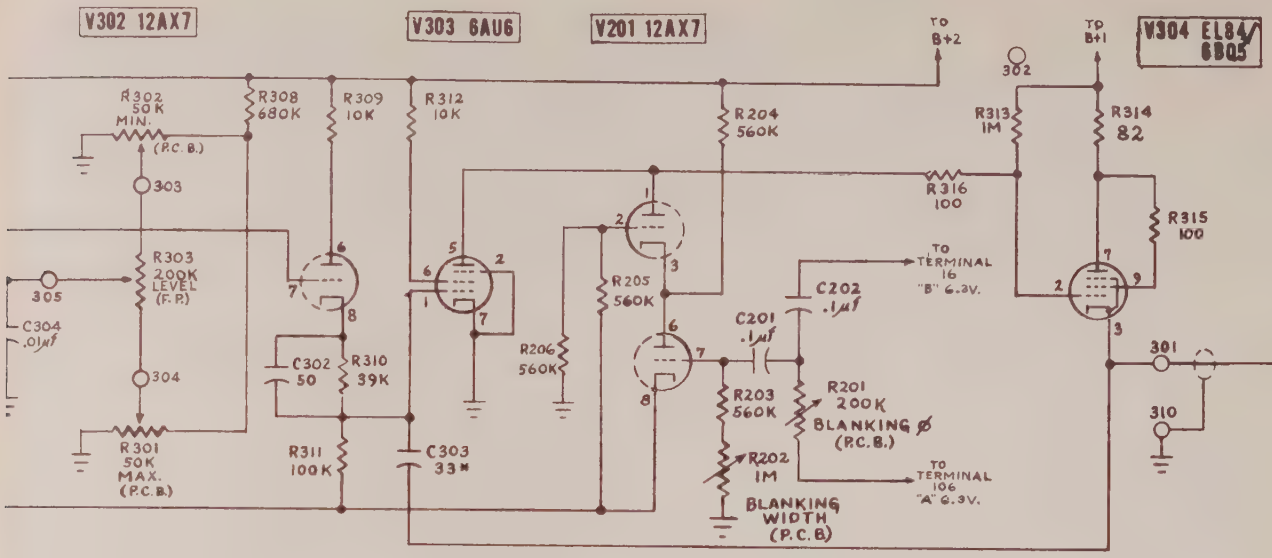
FRONT



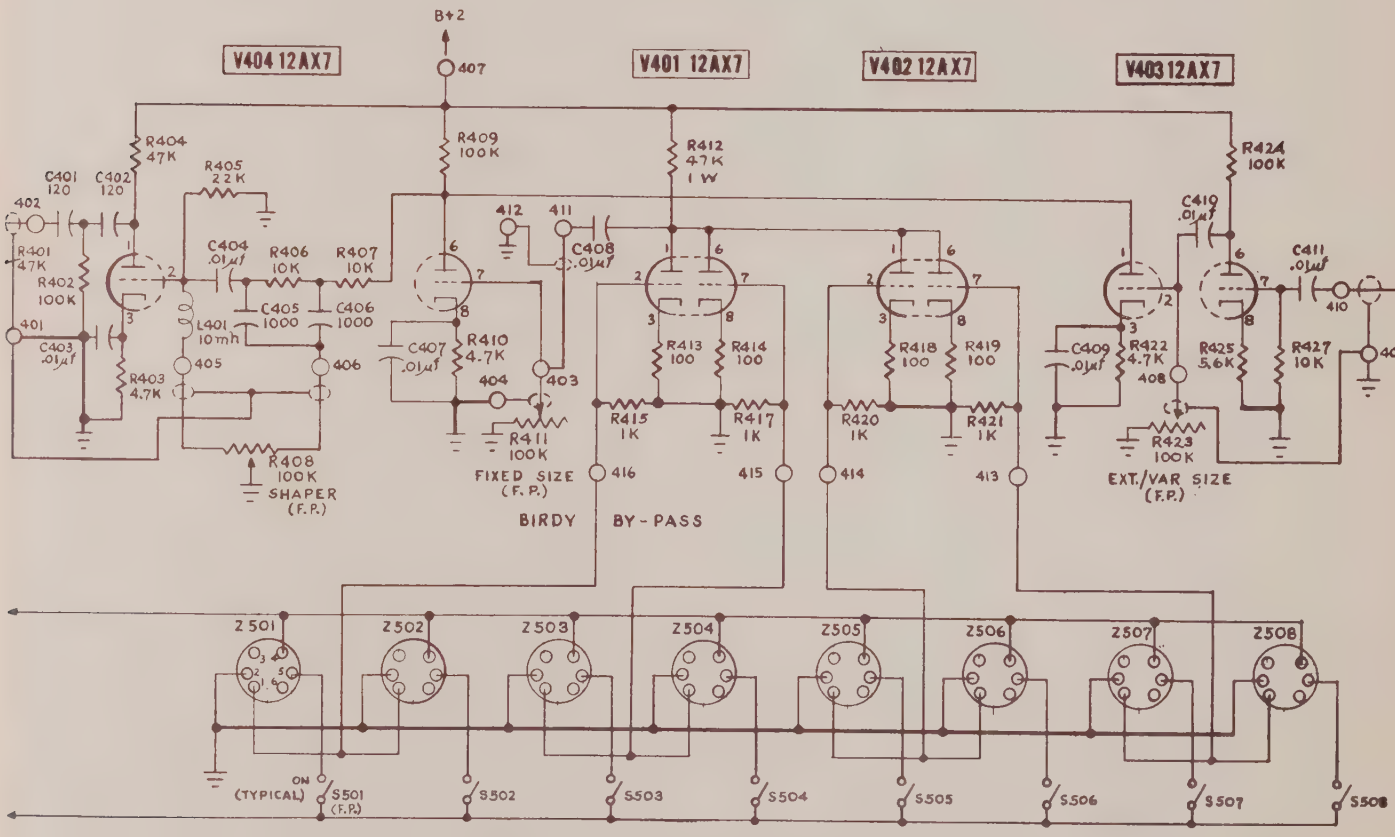


HORIZONTAL AND SWEEP DRIVE

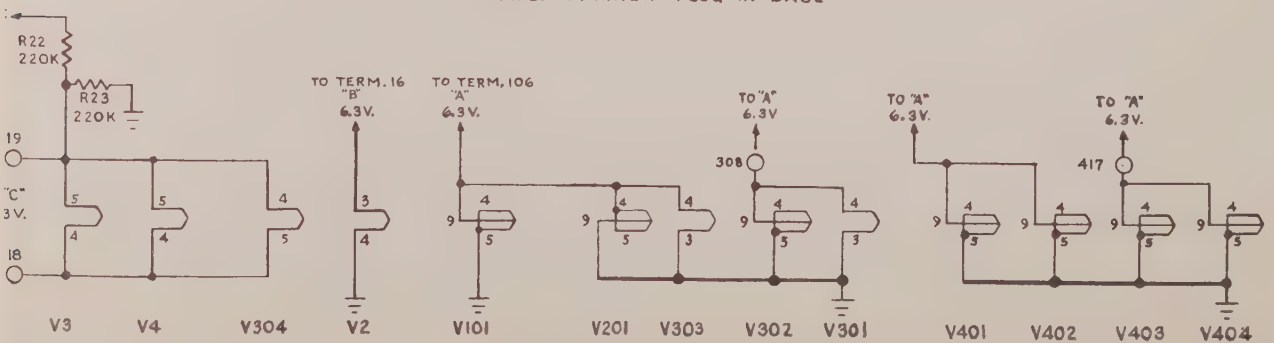


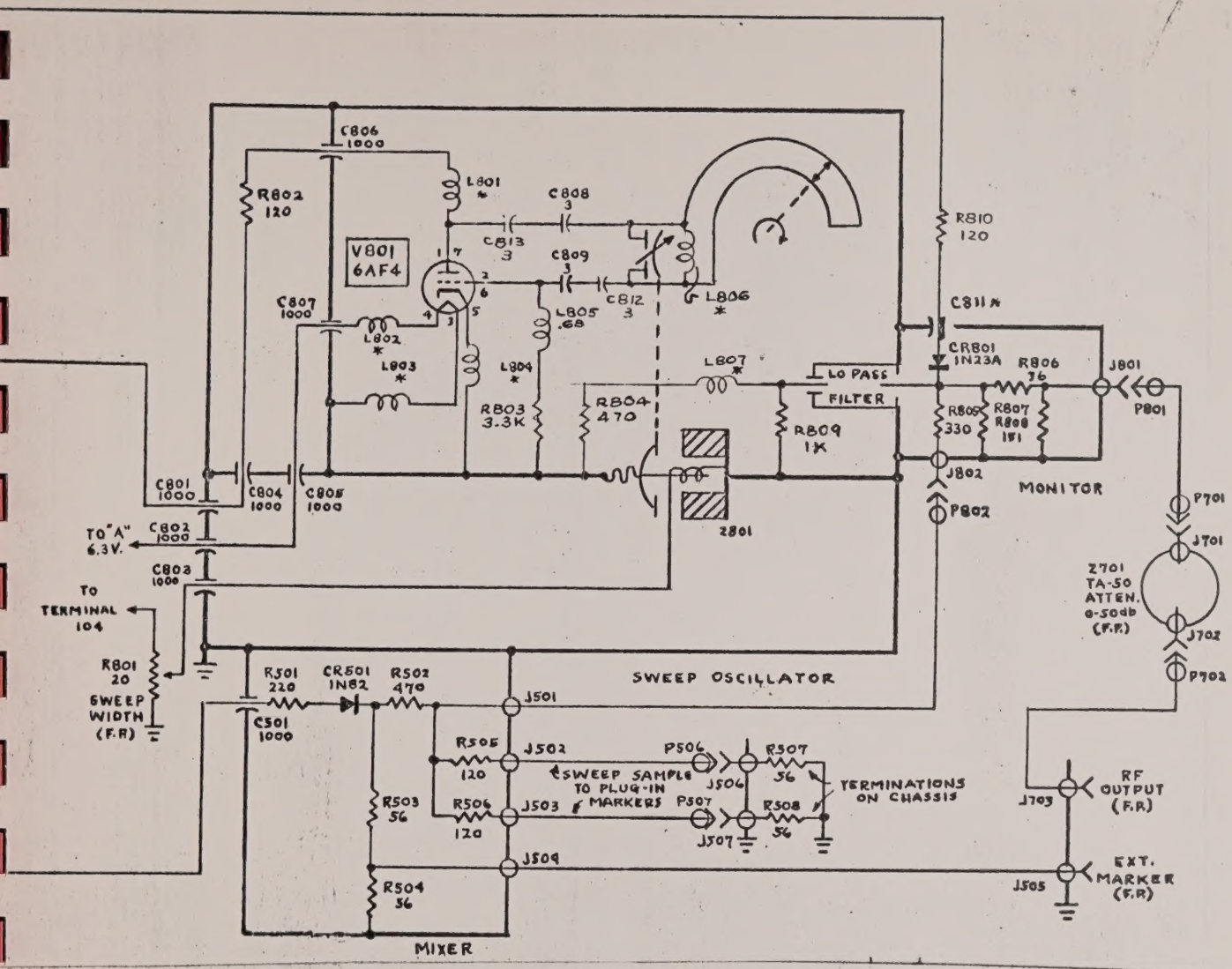


LEVELER AND BLANKING



FIXED MARKER PLUG-IN BASE





Tube types 6AF4A and 6DZ4 are used interchangeably in this instrument. The 6DZ4 is Telonic Part No. VT-51

INDUSTRIES INC.

BEECH GROVE, INDIANA